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(54) Production of pelletised animal fodder

(57) In a method of producing pelletised animal fodder preset amounts of dry, ground ingredient materials and liquid fat are mixed together. After conditioning the mixture with steam, the mixture is formed into pellets for example by delivering the mixture through two pelletising machines arranged in series. Then the exterior of the pellets is coated with a predetermined amount of additional fat, the weight of the additional fat coating being regulated by controlling the volume of fat delivered through a flowmeter. Means may be provided for calibrating the flowmeter by weighing a sample volume of fat delivered through the flowmeter.

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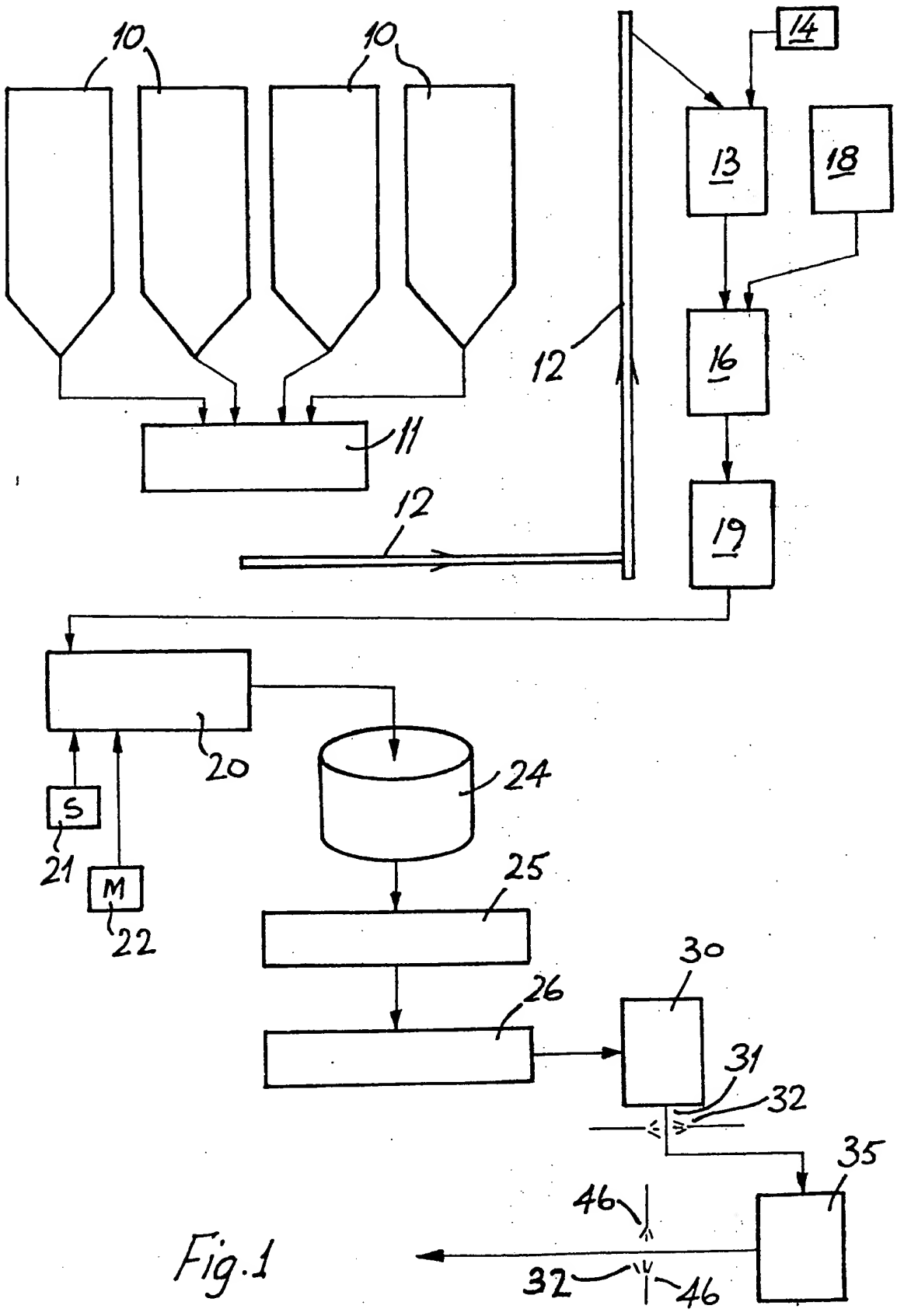

Fig.1

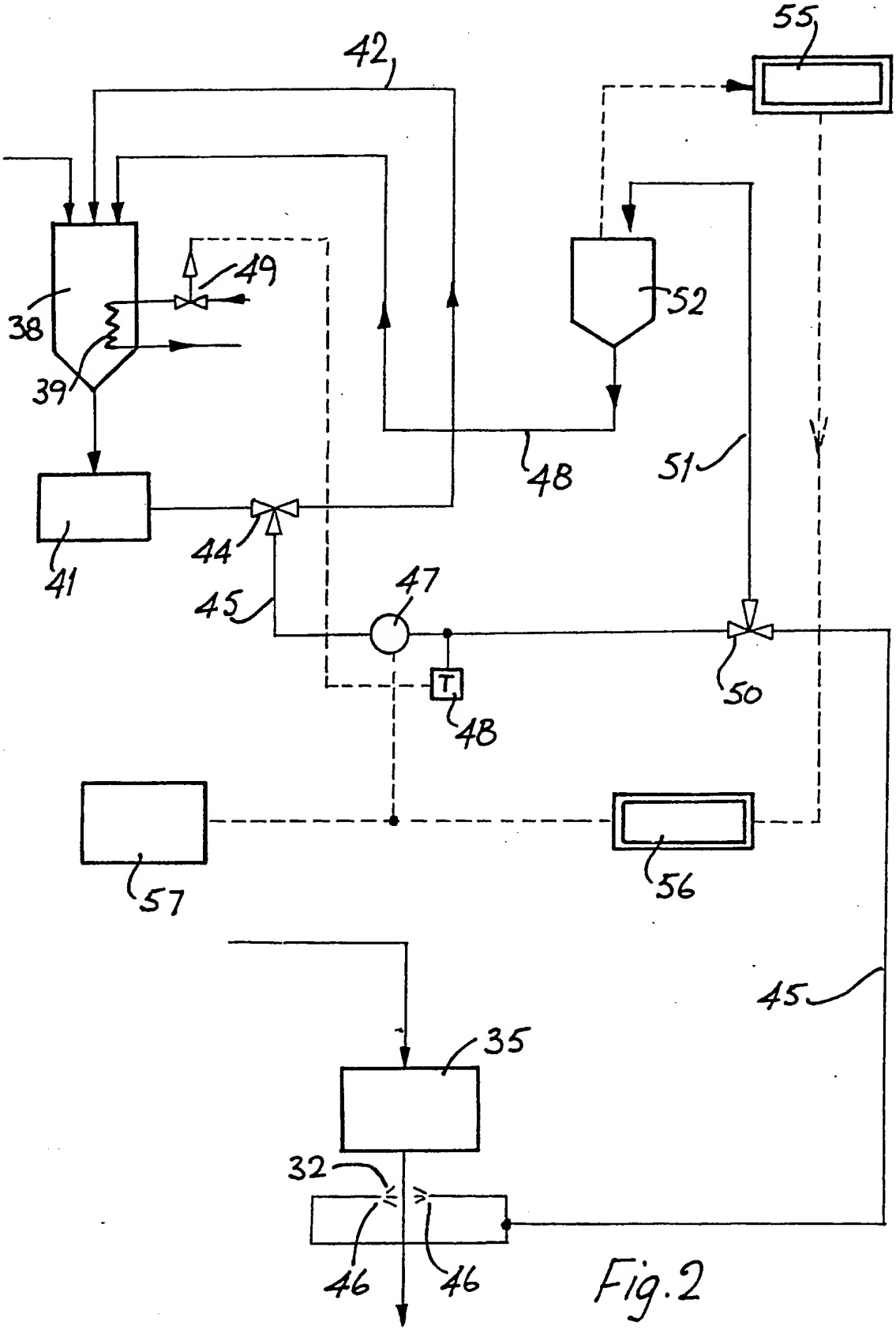

Fig. 2

"A method of producing pelletised animal fodder"

This invention relates to an improved method of producing pelletised animal fodder.

According to the invention there is provided a method of producing animal fodder in a pelletised form comprising the steps of:-

(a) weighing out preset amounts of a number of pre-selected dry ingredient materials and liquid fat,

(b) grinding the dry ingredient materials into a free flowing meal form,

(c) delivering the dry ingredient materials to a mixer,

(d) mixing the dry ingredient materials,

(e) adding the fat to the dry ingredient materials,

(f) blending the dry ingredient materials and fat to form a feed mixture,

(g) conditioning the feed mixture by adding steam to the feed mixture,

(h) forming the feed mixture into pellets, and

(i) coating an exterior of the pellets with a predetermined amount of additional fat in a controlled manner which includes regulating the weight of the additional fat coating applied to the pellets by controlling the volume of fat delivered to the pellets through a flowmeter, said volume of fat delivered corresponding to a desired weight of fat to be added to the pellets.

In a particularly preferred embodiment the method includes calibrating the flowmeter in a controlled manner by;

taking a preset sample volume of fat downstream of the flowmeter as recorded by the flowmeter,

weighing the sample volume,

comparing the weight per unit recorded volume of the sample with a preset desired weight per unit volume of fat to obtain a differential weight value,

and adjusting the volume of fat delivered through the flowmeter in response to the differential weight value to obtain a desired weight per recorded unit volume flow through the flowmeter.

Preferably the sample volume of fat is taken by delivering the sample volume to a sample weighing vessel and after weighing the fat, returning the fat from the weighing vessel to a fat reservoir for use.

In another embodiment the method includes the step of heating the additional fat with a heating means and regulating the temperature of the additional fat within pre-set temperature limits prior to delivery of the fat to the pellets. Preferably the temperature is regulated in response to a signal from a fat temperature sensing means in a delivery line for delivering the fat to the pellets. Ideally the fat temperature sensing means is mounted adjacent the flowmeter.

In a further embodiment the method includes circulating the additional fat in a ring main circuit comprising a fat reservoir having the heating means, and a pump which circulates fat from the reservoir through a fat circulating pipe and back to the reservoir, a fat delivery line branching from the fat circulating pipe to deliver fat through the flowmeter to the pellets. Preferably the heating means is a steam heater.

In a particularly preferred embodiment the additional fat is sprayed onto an exterior of the pellets.

In another embodiment the method includes the step of adding a binder to the mixture prior to pelletising the mixture. Preferably the binder is added to the mixture together with the steam. Typically the binder is molasses.

In a further embodiment pelletising is carried out in two or more stages, the mixture being delivered through a number of pelletisers arranged in series. Preferably, the pelletising is carried out in two stages.

In another embodiment the dry ingredient materials are stored in separate storage hoppers and the method includes delivering each of the dry ingredients in turn from the storage hoppers to a weighing vessel, for cumulative weighing of the pre-selected dry ingredient materials.

In another embodiment the method includes regulating the selection of the ingredient materials with a central processor, the central processor having a memory device with means for storage of a number of pre-defined recipes comprising combinations of the ingredients, and a control circuit for checking each storage hopper for presence of the required amount of each desired ingredient and for directing

delivery of the required amount of the ingredient from the storage hopper to the weighing vessel.

In another aspect the invention provides pelletised fodder whenever produced according to the method described previously.

The invention will be more clearly understood from the following description of an embodiment thereof given by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram illustrating a method of producing pelletised fodder according to the invention, and

Fig. 2 is a block diagram of a fat spray regulating circuit used in carrying out the method of the invention.

Referring to the drawings there is illustrated a method according to the invention for producing pelletised animal fodder. A number of ingredient materials are stored in storage hoppers 10. Required ingredients for a desired recipe are delivered from the storage hoppers 10 in turn to a weighing vessel 11. The selection of ingredient materials and their delivery to the weighing vessel is controlled by a central processor 57 (Fig. 2) described later. A pre-

determined amount of each material is accumulated in the weighing vessel 11. These ingredients are then ground into a free flowing meal form and delivered by a conveyor 12 to a mixer 13 where the dry ingredient materials are thoroughly mixed. A number of additives 14 such as trace elements, vitamins and medicines may at this point be added to the ingredients. The ingredients are then delivered to a blending bin 16. A pre-determined quantity of liquid fat weighed in a weighing bin 18 is delivered to the blending bin 16. The fat and other ingredients are mixed in the blending bin 16 to form a feed mixture which is delivered to a holding bin 19.

From the holding bin 19 the feed mixture is passed through a short term conditioner 20. In the short term conditioner 20, steam 21 and molasses 22 are added to the feed mixture the steam gelatinising the feed mixture. The short term conditioner 20 is of conventional construction comprising a generally cylindrical body having an inlet end and an outlet end. Feed mixture delivered to the inlet end from the holding bin 19 is delivered through the short term conditioner 20 by a paddle mixer/conveyor. Steam 21 and molasses 22 are mixed in with the feed mixture as it is delivered through the short term conditioner 20. Transit time through the short term conditioner 20 is about five to ten seconds. From the short term conditioner 20 the mixture is delivered to a long term conditioner 24. Within the long term conditioner 24 a rotating paddle slowly mixes the feed mixture which spends

about twenty minutes in the long term conditioner 24. A screw extractor 25 at an outlet of the long term conditioner 24 delivers the mixture through another short term conditioner 26 to a first pelletising machine 30.

In the pelletising machine 30 the feed mixture is formed into pellets. Pellets dropping from an outlet 31 of the pelletising machine 30 may be passed through a spray of fat 32 which coats an exterior of the pellets and delivered to a cooler (not shown) and to a storage vessel (not shown). Preferably, however, the pellets are delivered to a second pelletising machine 35 prior to coating with a spray of fat 32 and delivery to the cooler. Pelletising a second time gives more compacted pellets which are more resistant to disintegration when being handled. Each of the pelletising machines 30, 35 is of conventional construction comprising a rotatable annular die having a large number of radial holes. A pair of spaced-apart rollers are mounted within the die and engage against an inner surface of the die. Feed mixture delivered to an interior of the die is forced out through the holes in the die by the rollers thus forming the pellets. In the second pelletising machine 35 the thickness of the die is greater than in the first pelletising machine 30. Thus, the depth of the pellet-forming through holes in the die is greater which ensures greater compacting of material as the pellets are formed.

Referring now in particular to Fig. 2, the method for regulating the weight of fat sprayed onto an exterior of the pellets will be described. A fat circulating system is used comprising a fat reservoir tank 30 having steam heaters 39 to heat the fat. A pump 41 circulates heated fat in a ring main fat circulating pipe 42 which returns unused fat to the fat reservoir tank 38. A three-way valve 44 in the fat circulating pipe 42 downstream of the pump 41 connects with a fat delivery line 45 which branches from the fat circulating pipe 42. Spray heads 46 at an outer end of the fat delivery line 45 direct sprays of heated fat 32 onto pellets discharged from the second pelletising machine 35. A flowmeter 47 in the fat delivery line 45 shows the volume of fat delivered to the spray heads 46.

A temperature sensing means 48 of conventional construction is mounted on the fat delivery line 45 adjacent the flow meter 47. A control signal from the temperature sensing means 48 controls operation of a steam inlet valve 49 to the heater 39 in order to regulate the temperature of the fat to within pre-set temperature limits.

A three-way sampling valve 50 on the fat delivery line 45 downstream of the flowmeter 47 connects through a sample line 51 with a sample weighing vessel 52 which is suspended on a load cell (not shown). At regular intervals a pre-set volume of fat as recorded by the flowmeter 47 is delivered to the

sample weighing vessel 52. The weight of the sample volume is recorded on a test computer 55. This test computer 55 is in communication with a flow control computer 56 which regulates the volume through the flowmeter 47. A central processor 57 is also connected to the computers 55, 56, this central processor 57 governing overall operation of the pellet producing system. The computers 55, 56 compare the weight per recorded unit volume of the sample with a pre-set desired weight per unit volume of fat to obtain a differential weight value. If this differential weight value is zero no further action is taken. If however the differential weight value is not zero the volume of fat delivered through the flowmeter 47 is adjusted in response to the differential weight value to obtain the desired weight per unit volume flow through the flowmeter 47. After sampling the fat from the sample weighing vessel is returned to the fat header tank 38 through a fat return line 48.

The central processor 57 regulates the selection of the ingredient materials required for each feed mixture. It has a memory device with means for storage of a number of pre-defined recipes comprising combinations of the ingredients. There is a particular target diet feed to be achieved for each particular type of animal. These diet feeds will vary for cattle, pigs, hens etc. Each diet feed must provide minimum amounts of proteins, calcium, amino acids and the like and have a minimum calorific value. The central processor 57

weighs combinations of the ingredient materials in each feed recipe to meet the nutrient requirements at optimal cost. The central processor 57 also has a control circuit for checking each of the storage hoppers 10 for presence of the required amount of each desired ingredient and for directing delivery of the required amount of the ingredient from the storage hopper 10 to the weighing vessel 11. It will be noted that the memory device assigns priorities to each ingredient material and if a first choice ingredient material is not available in the required amount an alternative amount of another ingredient material will be substituted in the diet.

It will be appreciated that the proportion of fat in the feed in terms of the overall diet is relatively small. In this case the diet contains approximately 6% fat, comprised of 1% fat contained naturally in the raw materials and 5% supplied in liquid form. However the fat has a very high calorific value relative to the other ingredients and any variations in the amount of fat may have a big effect on the calorific value of the pelletised feed produced. If too little fat is applied the feed will lack the overall calorific value required. If too much fat is applied to the feed this may increase production costs significantly as the fat is an expensive ingredient, and it will also reduce the physical quality of the pellet. For optimum feed production therefor it is essential to accurately control the amount of fat added to the feed. As most heated fats are corrosive to metals and alloys,

accuracy of metering devices requires regular checking or control. The invention allows for in-line remote checking of accuracy without plant downtime or the use of extra manpower.

It will further be appreciated that if all the fat were to be added to the dry ingredient materials prior to blending this would lead to difficulties in pelletising the feed mixture as the larger amount of fat would tend to clog the pelletising die, and further the pellet strength would be reduced. By adding fat to the feed material in two stages as described advantageously a hard pellet can be initially formed by limiting the amount of fat initially mixed with the dry ingredients. Subsequent coating of the pellets with the fat spray then brings the feed value of the pellets into the desired calorific range. This also allows more close control of the overall fat content of the feed produced. A further advantage of applying the secondary fat spray coating is the improved sealing effect on the pellets.

The invention is not limited to the embodiment hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. A method of producing animal fodder in a pelletised form comprising the steps of:-

(a) weighing out pre-set amounts of a number of pre-selected dry ingredient materials and liquid fat,

(b) grinding the dry ingredient materials into a free flowing meal form,

(c) delivering the dry ingredient materials to a mixer,

(d) mixing the dry ingredient materials,

(e) adding the fat to the dry ingredient materials,

(f) blending the dry ingredient materials and fat to form a feed mixture,

(g) conditioning the feed mixture by adding steam to the feed mixture,

(h) forming the feed mixture into pellets, and

(i) coating an exterior of the pellets with a predetermined amount of additional fat in a controlled manner which includes regulating the weight of the additional fat coating applied to the pellets by controlling the volume of fat delivered to the pellets through a flowmeter, said volume of fat delivered corresponding to a desired weight of fat to be added to the pellets.

2. A method as claimed in claim 1 which includes calibrating the flowmeter in a controlled manner by;

taking a pre-set sample volume of fat downstream of the flowmeter as recorded by the flowmeter,

weighing the sample volume,

comparing the weight per unit recorded volume of the sample with a pre-set desired weight per unit volume of fat to obtain a differential weight value,

and adjusting the volume of fat delivered through the flowmeter in response to the differential weight value to obtain a desired weight per recorded unit volume flow through the flowmeter.

3. A method as claimed in claim 2 wherein the sample volume of fat is taken by delivery of the sample volume to a sample weighing vessel and after weighing the fat returning the fat from the weighing vessel to a fat reservoir for use.

4. A method as claimed in any preceding claim including the steps of heating the additional fat with a heating means and regulating the temperature of the additional fat within pre-set temperature limits prior to delivery of the fat to the pellets.

5. A method as claimed 4 wherein the temperature is regulated in response to a signal from a fat temperature sensing means in a delivery line for delivering the fat to the pellets.

6. A method as claimed in claim 5 wherein the fat temperature sensing means is mounted adjacent to the flowmeter.

7. A method as claimed in any preceding claim which includes circulating the additional fat in a ring main circuit comprising a fat reservoir having the heating means, and a pump which circulates fat from the reservoir through a fat circulating pipe and back to the reservoir, a fat

delivery line branching from the fat circulating pipe to deliver fat through the flowmeter to the pellets.

8. A method as claimed in any of claims 4 to 7 wherein the heating means is a steam heater.

9. A method as claimed in any preceding claim wherein the additional fat is sprayed onto an exterior of the pellets.

10. A method as claimed in any preceding claim including the step of adding a binder to the mixture prior to pelletising the mixture.

11. A method as claimed in claim 10 wherein the binder is added to the mixture together with the steam.

12. A method as claimed in claim 10 or claim 11 wherein the binder is molasses.

13. A method as claimed in any preceding claim wherein pelletising is carried out in two or more stages, the mixture being delivered through a number of pelletisers arranged in series.

14. A method as claimed in claim 13 wherein the pelletising is carried out in two stages.

15. A method as claimed in any preceding claim wherein the dry ingredient materials are stored in separate storage hoppers and the method includes delivering each of the dry ingredient materials in turn from the storage hoppers to a weighing vessel, for cumulative weighing of the pre-selected dry ingredient materials.

16. A method as claimed in any preceding claim wherein the method includes regulating the selection of the ingredient materials with a central processor, the central processor having a memory device with means for storage of a number of pre-defined recipes comprising combinations of the ingredients, and a control circuit for checking each storage hopper for presence of the required amount of each desired ingredient and for directing delivery of the required amount of the ingredient from the storage hopper to the weighing vessel.

17. A method substantially as hereinbefore described with reference to the drawings.

18. Pelletised fodder whenever produced according to the method of any of claims 1 to 17.

19. An installation for producing pelletised fodder according to the method of any of claims 1 to 17 including weighing means for the dry ingredient materials and liquid fat, a grinder for the dry ingredient materials, a mixer for the dry ingredient materials, a blending bin for mixing the dry ingredient materials and the liquid fat to form a feed mixture, a conditioner for adding steam and optionally molasses to the feed mixture, at least one pelletising machine to form the feed mixture into pellets and means for coating an exterior of the pellets with a preset amount of additional fat.

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